

Chapter I.—GENERAL EXPLANATIONS

This volume presents the statistics of the sixth biennial census of manufactures, which covered industrial operations during the calendar year 1931. The census of manufactures was taken decennially prior to 1899 and for each fifth year thereafter until 1919, and has since been taken at biennial intervals.

1. **Legal provision for biennial census.**—For the biennial censuses of manufactures, somewhat less detailed and comprehensive than the quinquennial censuses formerly taken, legal authority is found in section 32 of the Fourteenth Census Act and in section 17 of the Fifteenth Census Act.

2. **Area and period covered.**—The canvass covered the 48 States and the District of Columbia. The returns relate to the calendar year 1931, or, in the cases of some establishments, to business or fiscal years ended within the period from April 1, 1931, to March 31, 1932, and cover a year's operations, except for establishments which began or discontinued business within the year.

3. **Scope of the census.**—The census statistics are compiled primarily for the purpose of showing (1) the production of each important class or kind of manufactured commodities and the increase or decrease therein; (2) the absolute and the relative magnitude of the various manufacturing industries covered, and their growth or decline; and (3) the industrial importance of individual States and other areas.

a. General and detailed statistics.—The general statistical items in regard to which data were collected at the biennial census for 1931 are as follows: Number of wage earners, by months; amount paid in wages; cost of materials, containers for products, fuel, and purchased electric energy; and value of products. This information was obtained from all manufacturing establishments coming within the scope of the census. In addition, as explained under the head "Detailed statistics of products, materials, and equipment" (p. 10), data in regard to the quantities and the values of individual classes of products, and in some cases in regard to materials and equipment, were collected from establishments in the more important manufacturing industries.

Because of the necessity for economy, certain items of information obtained at preceding biennial censuses were omitted at the census for 1931; namely, those relating to salaried personnel (as distinguished from wage earners) and power equipment. Data on quantities of coal consumed were collected at the censuses for 1923, 1927, and 1929, and the quantities and costs of all fuel consumed were reported, by kind, for 1929, but no data of this character were called for on the schedules for 1931. The cost of materials and containers and the cost of fuel and purchased electric energy, which were reported separately at the quinquennial censuses and at the biennial censuses for 1927 and 1929, were reported in combination for 1931.

The table entitled "Size of establishments by value of products," which has appeared in the reports for prior census years except 1927, and that entitled "Size

of establishments by average number of wage earners," which was included in the reports for 1929 and for 1923 and prior years, have been omitted in this report in order to keep the cost of the Census of Manufacturers within the prescribed limit.

b. Establishments covered—Definition.—As a rule, the term "establishment" signifies a single plant or factory.

In some cases, however, it refers to two or more plants operated under a common ownership and located in the same city, or in the same county but in different municipalities or unincorporated places having fewer than 10,000 inhabitants. On the other hand, separate reports are occasionally obtained for different lines of manufacturing carried on in the same plant, in which event a single plant is counted as two or more establishments.

c. Establishments covered—Type.—The censuses for 1904 and subsequent years were confined, in general, to manufacturing establishments proper, exclusive of the hand and neighborhood trades, which had been covered by the censuses for 1899 and prior years. Data are collected for a few industries, however, whose activities are not manufacturing in the sense in which the term is generally understood, the most important example being printing and publishing. The production of motion pictures (not including distribution and projection in theaters) was treated as a manufacturing industry at each census from 1921 to 1929, inclusive, but was not so treated at the census for 1931. The industry was canvassed, however, and a report on it was published in pamphlet form.

Beginning with the census for 1904, the following classes of establishments have been omitted:

- (1) Establishments which were idle throughout the year or reported products valued at less than \$5,000. (See sec. d, below.)
 - (2) Establishments engaged principally in the performance of work for individual customers, such as custom tailor shops, dressmaking and millinery shops, and repair shops. (This does not apply to large establishments manufacturing to fill special orders.)
 - (3) Establishments in the building industries, other than those manufacturing building materials for the general trade.
 - (4) Establishments in the so-called neighborhood industries and hand trades, in which little or no power machinery is used, such as carpentry, blacksmithing, tin-smithing, etc.
 - (5) Cotton ginneries.
 - (6) Small grain mills (gristmills) engaged exclusively in custom grinding.
 - (7) Wholesale and retail stores which incidentally manufacture on a small scale, particularly where it is impossible to obtain separate data for the manufacturing and for the mercantile operations.
 - (8) Educational, eleemosynary, and penal institutions engaged in manufacturing. (Data for the production of binder twine in penal institutions and of brooms in institutions for the blind are, however, collected.)
- Most of the establishments of classes 3 and 4 also fall into class (2), their work being done mainly to individual order.

d. Establishments covered—Size.—At the biennial censuses, with certain exceptions explained in the following paragraph, data have been obtained only from establishments reporting products to the value of \$5,000 or more.

At the quinquennial censuses data on all subjects covered by the census were obtained from all establishments with products valued at \$500 or more. At the biennial censuses, however, in order to reduce the cost of the work and to facilitate the preparation of the statistics, no data (except in regard to wage earners and products, for 1921, and in regard to products only for a few industries, for later years) were collected from establishments with products valued at less than \$5,000. This change in the minimum value-of-products limit, which resulted in a 21.6

percent reduction in the number of establishments in regard to which general and detailed statistics were compiled at the census for 1921, did not otherwise materially impair the comparableness of the biennial and quinquennial figures, since 99.4 percent of the total wage earners and 99.7 percent of the total value of products reported at that census were contributed by the establishments reporting products to the value of \$5,000 or more.

4. **Revision of schedules.**—Because the census for 1929 belonged to the decennial as well as to the biennial series, the schedules were expanded as compared with those for the biennial censuses. This expansion was made in accordance with the recommendations of an advisory committee appointed by the Secretary of Commerce, the membership of which included representatives of important manufacturing industries and of industrial and research organizations. The additional inquiries adopted for 1929 were omitted at the census for 1931, and the schedules were further curtailed by the omission of the inquiries on salaried employees, on power equipment, and on quantity of coal consumed, this reduction having been rendered necessary by the decrease in the force available for carrying on the manufactures-census work.

The 1929 schedules for all but 76 of the industries called for data on sales (shipments or deliveries) instead of data on production. The results of this change (also made on the recommendation of the advisory committee referred to in the preceding paragraph) were unsatisfactory, and accordingly the Bureau has reverted to its former practice of calling for data on production. It is believed, however, that the change in question had very little effect on the comparableness of the statistics for 1929 with those for 1931 and those for 1927 and preceding biennial-census years, since it is likely that the excess of sales over production in some establishments and the excess of production over sales in others counterbalanced each other in large measure.

In all, 165 forms of schedules, covering 241 of the 310 industries recognized by the manufactures-census classification, were used at the census for 1931. The remaining 69 industries were canvassed by means of the "General" schedule. (See "Detailed statistics of products, materials, and equipment," p. 10.)

5. **The canvass.**—Schedules were mailed in January, 1932, immediately after the close of the year covered by the census, to all manufacturers who had reported at the census for 1929 and to others whose names were obtained from various sources, such as trade directories. About 60 percent of the manufacturers sent in their returns by mail, and the majority of those who failed to do so within a reasonable time were reached by means of an intensive telephone canvass by local chambers of commerce and by field representatives of the Bureau in the important industrial cities. As a result, approximately 85 percent of the returns were in by the end of June. Most of the remainder were obtained through the telephone canvass, and personal visits by field agents were necessary in the cases of only a comparatively few establishments. The usual cooperative arrangements were made with the Forest Service, of the Department of Agriculture, and the Department of Labor and Industries of Massachusetts.

6. **Publication of the statistics.**—The more important statistics were first given out in mimeographed press releases, issued as preliminary and subject to revision. Most of the final statistics have been published in the form of printed pamphlets, but some of them have been issued only in mimeographed or in rotaprinted form. All the final statistics are included in this volume. The printing of many of the industry reports and of this volume has been delayed about a year because of the lack of an adequate fund for census printing. All

the industry reports which could not be printed in 1933 were mimeographed in condensed form, thus making the more important final figures available, despite the delay in printing.

Preliminary industry reports, subject to revision, each covering a single industry, were issued in mimeographed form during the period from April 28 to December 30, 1932. In all, 218 such reports, covering all the more important industries (see "Classification of industries," p. 7), were given out. A mimeographed summary by industries was also published on December 30, 1932.

A second series of mimeographed reports, each giving semifinal summary statistics for a State, by industries, were issued during the period from March 21 to April 24, 1933; a mimeographed summary (semifinal) by States was published on March 9, 1933; a similar series of reports for industrial areas (see "Industrial areas," p. 17) were issued during the period from April 25 to July 20, 1933; a rotaprinted report giving monthly wage-earner-employment figures, by industries, was issued July 25, 1933; and a mimeographed report giving statistics for wage earners by months, by States, was made public on March 23, 1933.

Final reports (in pamphlet form), 77 in number, gave detailed statistics for single industries and for small groups of related industries. A summary by States and by industries was also published in pamphlet form. All these reports were prepared before the close of June, 1933, and 30 of them were printed before the close of the year; but, because of the depletion of the printing fund (referred to above), the remaining reports did not appear in printed form until the latter part of 1934.

7. Statistics for earlier census years.—For the purpose of general comparison of industrial activity in different census years, a summary for all industries (but not for individual industries) covering the period from 1849 to 1931 is given in Table 1, on page 19; and comparable figures for as many census years as possible, but in no case for any year prior to 1899, are given in Table 1 of the report for each industry.

Although the manufacturing industries of the country were canvassed at the censuses taken in 1810, 1820, and 1840, the results were not comparable with those of the manufactures inquiries made in 1850 (covering, in the main, industrial activities in 1849) and subsequent census years. The manufactures data collected at the decennial censuses taken during the period from 1850 to 1900, inclusive, covered the so-called "hand and neighborhood trades" as well as the factory industries only. (See "Establishments covered—Type," page 4.)

8. Adjustments in figures for earlier years.—It is sometimes necessary, for various reasons but chiefly because of changes in census classifications, to make adjustments in the figures for earlier census years. When such adjustments are of considerable magnitude, they are explained in headnotes or in footnotes; and when they are insignificant, and do not affect the comparableness of the statistics, the change is indicated by the footnote "Revised."

The statistics for 1899 (census of 1900) have been reduced to the factory basis by eliminating, so far as possible, the data for the hand and neighborhood trades, but no such elimination is possible for the earlier censuses. For this reason the statistics for years prior to 1899 are not comparable with those for 1904 and subsequent census years, but they indicate in a rough way the industrial progress of the country during the second half of the Nineteenth Century.

Two sets of figures are given in Table 1, p. 19, for 1899, one including data for the hand and neighborhood trades in order to preserve comparableness between 1899 and earlier years, and the other excluding such data in order to make the figures for 1899 comparable with those for later years. The financial items for 1869, which were reported in inflated currency worth in gold about 80 percent of its nominal value, have been reduced to a gold basis in this presentation in order to make the figures for that year comparable with those for preceding and following census years.

9. Price changes.—In comparing the figures for cost of materials, value of products, and value added by manufacture for different

census years, price changes should be taken into account. To the extent to which this factor was influential, the figures fail to supply true indices of the actual increase or decrease in manufacturing activities.

10. Classification of industries.—Although there are thousands of more or less distinct lines of manufacturing activity, manufacturing establishments have been classified for census purposes into 310 industries. (Because of changes resulting from the establishment of new industry classifications and the combination or abandonment of old ones, the number varies slightly from census to census.)

The production of each specific class of finished commodities, however small, might be looked upon as a separate industry; and in some cases certain of the distinct processes in the manufacture of a single commodity might be treated as distinct industries, as, indeed, is sometimes actually done in the census reports. Manifestly, however, there must be some grouping of commodities and processes, not only in order to bring the number of industries within reasonable compass, but also in order to avoid the extensive overlapping which would result from an attempt to distinguish so large a number of industries. Each establishment must, as a rule, be treated as a unit, and the data reported by it must be assigned in toto to some one industry. In many cases an establishment manufactures several related articles or commodities, or performs several related operations. It is desirable, therefore, that the classification be broad enough to cover all the activities—or, at least, the principal activities—of such establishments.

The effort has been made to distinguish, so far as practicable, each well-defined or well-recognized industry. The classification has been based on prevailing conditions as to the actual organization of industry and the distribution of the various branches of production among individual establishments. It has been necessary, however, in some cases to combine the data for two or more industries which are usually considered fairly distinct from one another, because of the considerable amount of overlapping among them. Such cases arise where, although the majority of the establishments concerned confine their business to one or another of the industries, a few important establishments combine the activities of two or more industries to such an extent as to render it impracticable to obtain separate data for the different lines of activity.

11. Classification of establishments.—Each establishment as a whole (a single plant being counted as two or more establishments in certain cases, as explained in sec. 3b) is assigned, on the basis of its product or group of products of chief value, to some one industry classification.

The statistics as to cost of materials, value of products, and value added by manufacture for any particular industry relate not only to the primary products normally belonging to that industry but also to certain secondary products which normally belong to other industries. For example: Some of the establishments classified in the Motor Vehicle industry manufacture, as secondary products, tractors, which are normally products of the "Engines, Turbines, Tractors, Water Wheels, and Windmills" industry, while a few motor vehicles are made as secondary products by establishments engaged primarily in other lines of manufacture.

The treatment of each establishment as a unit and its assignment to some one industry according to its product of chief value sometimes result in overrating the importance of certain industries and underrating that of others. For example: The industry classified as "Wire Drawn from Purchased Rods" embraces, as its title signifies, only those establishments which draw wire from rolled rods purchased from other establishments. Many rolling mills operate wire-drawing departments; and wire and wire products are also manufactured in considerable quantities by establishments classified under the designations "Nonferrous Metal Alloys; Nonferrous Metal Products, Except Aluminum, Not Elsewhere classified" and "Electrical Machinery, Apparatus, and Supplies."

The total output of wire and wire products by the establishments in the "Wire Drawn from Purchased Rods" industry in 1931 was valued at \$77,330,841, whereas the total value of wire and wire products manufactured by all establishments which drew wire in 1931 amounted to \$255,899,356. Thus the output of

the wire industry represented less than one-third of the value of wire and wire products manufactured in all wire-drawing establishments. On the other hand, it should be noted that the \$255,899,356 reported as the total for all establishments engaged in drawing wire does not represent the value of wire alone but includes a considerable value of manufactures of wire, such as wire fencing, wire nails and spikes, and wire rope and strand—products similar to those manufactured from purchased wire by establishments under other classifications.

12. Classification by industry groups.—To facilitate the comparison of one broad class of manufacturing industries with another, the industries as constituted for census purposes are distributed into 16 general groups, for which summary statistics are given in the table on p. 37.

This grouping is based in most cases on the character of the principal materials used, but several of the groups are constituted on the basis of the purpose or use of the chief products, and one, "Chemicals and Allied Products," on the character of the manufacturing processes employed. It is necessary, of course, in some cases to include in a particular group certain industries which use considerable quantities of materials or manufacture considerable quantities of products other than those treated as basic for the group. For example: The furniture industry, included in the Forest Products group, embraces the manufacture of metal as well as of wooden furniture.

At the censuses for 1921 and prior years the classification comprised only 14 groups of industries. At the census for 1923 the industries were rearranged into 16 groups and the statistics for prior years were adjusted to make them comparable so far as possible, with those for 1923. After the publication of the report for 1925 each of two of the former groups was divided into two, and two others were consolidated with the "Miscellaneous industries" group. The present grouping is as follows:

- Group 1.—Food and kindred products.
- Group 2.—Textiles and their products.
- Group 3.—Forest products.
- Group 4.—Paper and allied products.
- Group 5.—Printing, publishing, and allied industries.
- Group 6.—Chemicals and allied products.
- Group 7.—Products of petroleum and coal.
- Group 8.—Rubber products.
- Group 9.—Leather and its manufactures.
- Group 10.—Stone, clay, and glass products.
- Group 11.—Iron and steel and their products, not including machinery.
- Group 12.—Nonferrous metals and their products.
- Group 13.—Machinery, not including transportation equipment.
- Group 14.—Transportation equipment, air, land, and water.
- Group 15.—Railroad repair shops.
- Group 16.—Miscellaneous industries.

13. Wage earners.—Wage earners are defined as skilled and unskilled workers of all classes, including pieceworkers employed at the plant, and foremen and overseers in minor positions who perform work similar to that done by the employees under their supervision. The number shown by the pay roll for the week which included the 15th day of each month, or for some other representative week, is reported by each manufacturer, and the average for the year is calculated by dividing the sum of the numbers reported for the several months by 12.

As explained in Chapter IV (page 1176), the average number of wage earners in any industry, as calculated from the returns made by manufacturers, is necessarily somewhat in excess of the number that would be required to perform the work in that industry if all were continuously employed during the year.

At prior censuses data on proprietors and firm members and on salaried officers and employees were collected, but because of the necessity for economy, no such data were called for on the schedules used for 1931.

14. **Cost of materials, etc.**—This item, as it appears in the current report, covers the combined cost of materials, containers for products, fuel, and purchased electric energy. The cost of fuel covers coal, fuel oil, gasoline, gas, etc. (See sec. 18, p. 10.)

15. **Contract work.**—The term "contract work"—which does not necessarily imply the existence of a formal contract—is applied both to work done outside the establishment reporting on materials owned by it and to work done in the establishment on materials not owned by it.

Payments made for such work appear under the head "Paid for contract work"; amounts received are reported under "Value of products." The amounts paid for contract work are given in the reports for only those industries in which such work is important, namely, the clothing and leather-glove industries and a few others. In the great majority of manufacturing industries, the contract work is small in amount and in many cases is merely incidental; that is, it is not a normal or a necessary part of the industry's activity.

16. **Value of products.**—For 1931 and for years prior to 1929, the amounts under this heading are the selling values, *f.o.b. factory*, of all products manufactured (or, for some industries, receipts for all work done) during the census year, whether sold or in stock, and consequently the total value of products covers cost of production (including overhead expenses) and profits, except in cases where the factories were operated at a loss. It also covers selling expenses except for those establishments which maintain separate sales departments, in which cases the values at which the products are turned over to the sales departments are reported. For 1929 the value of products was, for the majority of the industries, the selling value, *f.o.b. factory*, of products *shipped or delivered* during the year, but for 76 industries, including some of the most important ones, it represented products manufactured, whether sold or not. (See sec. 4.)

The value of products is not a satisfactory measure of the importance of a given industry, because only a part of this value is actually created within the industry. Another part, and often a much larger one, is contributed by the value of the materials used. The aggregates for cost of materials and value of products include large amounts of duplication due to the use of the products of some industries as materials by others. (See "Duplication in cost of materials and value of products," p. 10.) Furthermore, in the cases of several industries the value of products includes considerable amounts representing receipts for contract work. (See "Contract work," above.)

Some manufacturers sell their products at prices which include freight and other delivery charges, but these transportation charges are deducted wherever possible.

The repair shops of steam and electric railroads manufacture few if any products for sale, their work being done or their products manufactured solely or principally for the use and benefit of the railroads operating them. Since no market value is assigned to the work or the products of railroad repair shops, the value reported by them usually represents the operating cost or the cost of production.

Somewhat akin to the case of the railroad repair shops is that of establishments which make partly finished products, or containers and auxiliary articles, for the use of other manufacturing establishments under the same ownership. For example: A blast furnace produces pig iron, which is used in the production of steel in plants under the same ownership. In such cases the "transfer value" assigned by the manufacturer is accepted as the value of the pig iron. This transfer value is usually based on market prices or on the cost of manufacture, but sometimes it is purely arbitrary.

Primary and secondary products.—The products reported for a given industry usually include minor products different from those covered by the industry

designation. They do not, however, include the entire output of products normally belonging to the industry, because some of this class of commodities may be made in establishments in which they are not the products of chief value. In the case of every industry the value of the secondary products not normally belonging to it, and that of commodities normally belonging to it but made as secondary products by establishments engaged primarily in other lines of manufacture, offset one another to a greater or less extent; and in most cases the total value of products as reported does not differ greatly from the value of the total output, in all industries, of the classes of products covered by the industry designation. (See "Classification of establishments," p. 7.)

In most of the product tables in this volume (Table 3 in the reports of most industries) a separate item, entitled "Other products (not normally belonging to the industry)," represents the production of commodities which normally are primary products of other industries. It has been necessary in some cases to distinguish between these secondary products normally belonging to other industries and minor or miscellaneous products of the industry covered by the report.

17. Detailed statistics for products, materials, and equipment.—For the more important industries data as to the quantities and values—or where quantity figures would have no particular significance, for the values only—of the separate classes of products are collected and tabulated. For some, but not all, of these industries the quantities and cost of principal materials used were reported; and for a few industries detailed data in regard to equipment were also collected.

While it is generally impracticable for an establishment to assign the proper proportions of its wage earners, wages, etc., to the various lines of manufacturing industry carried on within it, most establishments are able to distinguish, exactly or approximately, the quantities and values of the several classes of products made. Special schedules calling for detailed information in regard to products were therefore sent to the establishments in 241 industries, and in some cases several different special schedules were filled out by a single establishment whose manufacturing activities were of a varied character. The general manufactures schedule, which was sent to the establishments in the remaining 69 industries, also contained spaces for listing the quantities and values of the leading products separately, but in some instances it was found impracticable to obtain such information.

The tables giving detailed statistics on the products of a given industry include, in most cases, data for the production of similar commodities normally belonging to that industry but made as secondary products by establishments classified in other industries. In a few cases this secondary production is shown in footnotes. (See "Value of products—Primary and secondary products," above.)

Detailed data as to materials used were collected from establishments in many industries, including Bread and Other Bakery Products, Flour and Other Grain-Mill Products, Gas, Confectionery, the Rubber industries, and the Textile industries. In addition, special statistics of equipment are given for a number of industries, such as Blast-Furnace Products, Steel Works and Rolling-Mill Products, and Wire Drawn from Purchased Rods.

18. Duplication in cost of materials and value of products.—In making use of the statistics for cost of materials and value of products it must be remembered that they include a large amount of duplication due to the use of the products of certain establishments as materials by others. The net value of all manufactured products is estimated to have been approximately two-thirds of the gross value for 1929. (See table 7, p. 36, Vol. II of reports for that year.) No corresponding estimate has been made for 1931.

This duplication occurs, as a rule, between different industries and is not found to any great extent in individual industries. To illustrate: Manufacturers classified in the Rubber Tires and Inner Tubes industry sell a part of their output to manufacturers in the Motor Vehicle industry for installation on new cars and trucks. Thus the value of these tires is included in the total values of products of two industries.

The occasional occurrence of duplication between different establishments in the same industry is exemplified in Meat Packing, where certain packing establishments purchase fresh meat from slaughterhouses for use as their material. The total value of products reported for the industry, therefore, includes the factory value of products which pass through further manufacturing processes in other establishments.

If all manufacturers consumed only raw materials and turned out only products ready for ultimate consumption, the figures for their combined activities would contain no duplication in the cost-of-materials and value-of-products items. Manufacture, under these hypothetical conditions, would consist simply in adding value to the basic raw materials on which all the successive operations were performed within a single establishment. The report made for such an establishment would show the original cost of the raw materials and the final value of the products ready for sale to ultimate consumers, both entirely free from duplication.

19. Relation of wages to cost of materials and value of products.—In making comparisons between the wages paid in manufacturing industries and the cost of materials and value of products of these industries, it should be borne in mind that whereas the materials and products items contain large amounts of duplication, the wage figures are free from duplication.

Moreover, the cost of materials, excluding the duplication therein, is made up in considerable part of wages paid to wage earners in nonmanufacturing industries, such as agriculture, mining, fisheries, and transportation. For example: The iron ore used as a material in blast furnaces comes from iron mines and is transported to the furnaces by rail or by water. The cost of the ore at the mines consists in part of the miners' wages, and the cost of the ore delivered at the furnace includes also the wages paid to the employees of the navigation or railroad company which transported it. The pig iron produced by the blast furnaces is used as a material by steel mills. Thus the cost of this material is made up in part of the miners' wages, in part of the wages paid to the transportation employees, in part of the wages of the blast-furnace employees, and in part of other items. The wages paid the blast-furnace employees are included in the total wages shown by the manufactures reports, but the miners' wages and the wages of the transportation employees are not included. Moreover, the cost of the pig iron used as a material by the steel mills includes that of the iron ore, fuel, and supplies used by the blast furnaces. If the steel mill and the blast furnace were treated as a single establishment, this duplication would be eliminated and the cost of materials would be that of the iron ore, etc., used by the blast furnace, and the corresponding duplication in value of products would also disappear. If the mine, the transportation company, the blast furnace, and the steel mill were operated under a single ownership and treated as a single establishment, the cost of materials would be reduced to the value of the ore in the ground and the cost of fuel and supplies; the value of products would be a net amount representing the output of the steel mill alone instead of being made up of the value of the steel-mill products plus the value of the blast-furnace products; and the wage item would cover all wages instead of being limited to the wages paid in the blast furnace and the steel mill.

Thus, if the aggregate amount of wages paid both in manufacturing industries and in those industries which supply the raw materials used by manufacturers were compared with the net cost of materials, fuel, etc., or with the net value of manufactured products in the form in which they reach the ultimate consumer the ratio of the first amount to the second or to the third would be much larger than the ratio of the wages paid in manufacturing industries alone to the gross cost of materials or to the gross value of manufactured products.

20. Value added by manufacture.—For some purposes, the most satisfactory measure of the importance of an industry is the "value

added by manufacture"—that is, the increment created by the manufacturing processes. This measures the net addition to the value of commodities in existence—i.e., raw materials, semimanufactured materials, and fuel.

It is calculated by deducting the cost of materials, containers, fuel, and purchased electric energy used from the value of the products. The cost of purchased energy is included in the amount deducted because it is not reported separately by the manufacturers. (See also Sec. 22.)

In comparing manufacturing industries with one another the relation between the value of finished products and the cost of materials should be kept constantly in mind. The products of one industry may be valued at the same amount as those of another, but the one may have added several times as much value to the materials as the other, and may therefore have been of correspondingly greater economic importance.

Statistics of "value added by manufacture" are almost entirely free from the duplication which is a factor in the total value of products. (See Sec. 18.) They include a small amount of duplication due to the fact that certain establishments perform contract work on materials owned by other establishments (see Sec. 15) and report the amount received for such work in lieu of value of products. As the resultant duplication in value of products is not offset by any corresponding duplication in cost of materials (since the amounts paid for contract work are not included therein), it appears also in value added by manufacture. The amount of this duplication is insignificant except in a few industries, particularly the manufacture of clothing.

21. Production as measured by physical volume.—Because of price changes, the values of products for different census years are, in many instances, not properly comparable. Statistics of the actual physical quantities of products manufactured provide the most accurate available measure of the growth or decline of manufactures, but they are not available for all industries.

The number of wage earners employed is also a fairly satisfactory standard, but it must be remembered that, on the one hand, in some industries mechanical processes have displaced hand labor to such an extent as to make possible a marked increase in production with no increase in the number of wage earners, while, on the other hand, the average number of hours of labor per week has been decreasing for many years.

A study of the physical volume of output as disclosed by census figures was made for the Bureau of the Census by Edmund E. Day and Woodlief Thomas, and the results were published in 1928 under the title "The Growth of Manufactures," as one of a series of Census monographs.

The indexes of physical output given in Table 1, page 18, for 1899 to 1925, inclusive, are the Day-Thomas figures for those years, and the index for 1927 was computed by the same method by Miss Aryness Joy, of the Federal Reserve Board.¹ These indexes are weighted geometric averages of relatives, computed on a 1919 base. The output of each product for which satisfactory quantity statistics were available was compared with the output for 1919, and the relatives weighted and combined by use of a geometric average. The index for 1929 (revised since the publication of the report for that year) was constructed by applying to the 1927 index as a base the percent of increase of production in 1929 over that of 1927 as determined by the National Bureau of Economic Research, under the direction of Frederick C. Mills, by a method differing slightly from that employed by Day and Thomas. Similarly, the 1931 index was constructed by applying to the 1929 index as a base the percent of decrease as calculated by Mills.

The figures in the second column of Table 1, representing the total volume of wage-earner employment in each of the census years beginning with 1899, are a series of relatives computed by dividing the number of wage earners (average for the year) employed in manufacturing establishments in 1899 (=100) into the average number for each census year thereafter. "Production per wage earner" (fourth column), determined by dividing the index of physical output for each census year by the wage-earner index in the second column, indicates the general

¹ The method employed in constructing the 1927 index was described in an article by Miss Joy in the *Journal of the American Statistical Association*, December, 1930, pp. 453-459.

trend in output per wage earner, although in failing to reflect changes in mechanization of industry it falls short of being an entirely satisfactory index of productivity.

22. Profits and production costs.—Manufacturers' profits cannot be calculated from census statistics, for the reason that these statistics do not show total production costs.

Costs for which data have not been collected comprise salaries, depreciation, interest, insurance, rent, taxes, and other miscellaneous expense items. (Data for salaries—compensation of salaried officers and employees, as distinguished from compensation of wage earners—were, however, collected at former censuses.)

The deduction of the sum of wages and cost of materials, containers, fuel, and purchased electric energy from value of products leaves a miscellaneous item (equal to the remainder obtained by subtracting the wage item from "value added by manufacture") representing all other manufacturing expenses plus *manufacturing* profits (or minus manufacturing losses), but no basis exists in census data for distributing this amount among the constituent items of expense and profits. In fact, the books of a manufacturer who actually operated at a loss might nevertheless show a considerable excess of value of products over the sum of the expense items reported to the Census Bureau.

23. Disclosure of data for individual establishments.—The Bureau of the Census is prohibited by law from publishing any statistics which might disclose data relating to individual establishments.

For this reason it is necessary to omit all the State figures for a few industries and to include, in the "Other States" items for practically all industries and in the "Other industries" items for all States, the data for certain States and for certain industries, respectively, which are more important than some of those for which separate figures are presented.

In general, separate figures are published in cases where a given industry in a given State is represented by three or more establishments. It sometimes happens however, that one or two establishments produce a very large proportion of the combined output of three or more establishments in a particular State, and in such cases separate figures are not given. To illustrate: Suppose that the combined production of 2 manufacturers amounted to 90 percent of the total for a group of 5. Under such conditions either of the 2 manufacturers in question, knowing that he had only 1 important competitor in his State, could subtract the value of his products from the combined value for the group of 5 and thus obtain an amount which would not greatly exceed the value of the products of his principal competitor. In cases like this the figures for the group in question are included in the "Other States" items in the industry table or in the "Other industries" items in the State table.

24. Changes in groups, industry titles, and classifications.—The following list gives the changes made in industry titles and classifications at the census for 1931 and names the abandoned industries:

GROUP 1.—FOOD AND KINDRED PRODUCTS

Canning and preserving: Fish, crabs, shrimps, oysters, and clams.—Title changed to "Canned and preserved fish, crabs, shrimps, oysters, and clams."

Canning and preserving: Fruits and vegetables; pickles, jellies, preserves, and sauces.—Title changed to "Canned and dried fruits and vegetables; preserves, jellies, fruit butters, pickles, and sauces."

Oleomargarine, not made in meat-packing establishments.—Title changed to "Oleomargarine and other margarines, not made in meat-packing establishments."

Shortenings (not including lard) and vegetable cooking oils.—Title changed to "Shortenings (other than lard), vegetable cooking oils, and salad oils."

GROUP 2.—TEXTILES AND THEIR PRODUCTS

Clothing, work (including sheep-lined and blanket-lined work coats but not including shirts), men's.—Title changed by deleting "work" before "coats."

Flax and hemp, dressed.—Abandoned as a manufacturing industry; considered a quasi-agricultural activity.

Nets and seines.—Title changed to "Nets (fish) and seines."
Regalia, badges, and emblems.—Title changed to "Regalia, robes, vestments, and badges."
Silk and rayon manufactures.—Title changed to "Silk and rayon goods."

GROUP 3.—FOREST PRODUCTS

Pulp goods.—Title changed to "Pulp goods and molded composition products."
Wood turned and shaped and other wooden goods, not elsewhere classified.—Expanded to include manufacture of such turned wood products as felloes, hubs, and spokes, formerly classified in "Carriage, wagon, sleigh, and sled materials" (Group 14).

GROUP 4.—PAPER AND ALLIED PRODUCTS

Labels and tags.—Abandoned as a separate classification. Printed labels are now classified in "Printing and publishing, book and job" (Group 5); other labels and tags, according to kind, in "Engraving (other than steel, copperplate, or wood), chasing, etching, and diesinking" (Group 5), "Lithographing" (Group 5), or "Miscellaneous articles, not elsewhere classified" (Group 16).

GROUP 5.—PRINTING, PUBLISHING, AND ALLIED INDUSTRIES

Engraving, steel and copperplate, and plate printing.—Combined with "Engraving, wood," under new title, "Engraving, steel, copperplate, and wood, and plate printing."

Engraving, wood.—See "Engraving, steel," etc., above.

Printing and publishing, book and job.—Expanded to include production of printed labels, formerly classified in "Labels and tags" industry (Group 4).

GROUP 6.—CHEMICALS AND ALLIED PRODUCTS

No changes.

GROUP 7.—PRODUCTS OF PETROLEUM AND COAL

Coke, not including gas-house coke.—Title changed to "Coke-oven products."
Fuel: Briquettes and boulets.—Title changed to "Fuel briquettes."

GROUP 8.—RUBBER PRODUCTS

No changes.

GROUP 9.—LEATHER AND ITS MANUFACTURES

Saddlery and harness.—Expanded to include manufacture of whips, formerly a separate classification in Group 16, under new title, "Saddlery, harness, and whips."

GROUP 10.—STONE, CLAY, AND GLASS PRODUCTS

Abrasive wheels, stone, paper, and cloth, and related products.—New title; consolidation of three classifications, formerly separate, as follows: "Emery wheels and other abrasive and polishing appliances" and "Hones, whetstones, and similar products" (Group 10); "Sandpaper, emery paper, and other abrasive paper and cloth" (Group 16).

Clay products (other than pottery) and nonclay refractories.—Expanded to include manufacture of crucibles, formerly a separate classification.

Crucibles.—Abandoned as a separate industry classification; combined with "Clay products (other than pottery) and nonclay refractories."

Emery wheels and other abrasive and polishing appliances.—See "Abrasive wheels, stones, paper, and cloth, and related products," above.

Glass products (except mirrors) made from purchased glass.—Combined with "Mirrors, framed and unframed," under new title "Mirrors and other glass products made of purchased glass."

Hones, whetstones, and similar products.—See "Abrasive wheels, stone, paper, and cloth, and related products," above.

Mirrors and other glass products, made of purchased glass.—See "Glass products," etc., above.

Mirrors, framed and unframed.—Combined with "Glass products (except mirrors) made from purchased glass." (See above.)

Statuary and art goods, factory product.—Title changed to "Statuary and art goods (except concrete), factory production."

GROUP 11.—IRON AND STEEL AND THEIR PRODUCTS, NOT INCLUDING MACHINERY

- Blast-furnace products.**—Formerly "Iron and steel: Blast furnaces."
Cast-iron pipe.—Title changed to "Cast-iron pipe and fittings."
Doors, shutters, and window-sash and frames, metal.—Title changed to "Doors, shutters, and window sash and frames, molding, and trim, metal."
Iron and steel: Blast furnaces.—Title changed to "Blast-furnace products."
Iron and steel, processed.—Combined with "Foundry and machine-shop products, not elsewhere classified" (Group 13).
Iron and steel: Steel works and rolling-mills.—Title changed to "Steel-works and rolling-mill products."
Steam fittings and steam and hot-water heating apparatus.—Title changed to "Steam and hot-water heating apparatus and steam fittings."
Steel-works and rolling-mill products.—Formerly "Iron and steel: Steel works and rolling mills."
Structural and ornamental iron and steel work, not made in plants operated in connection with rolling mills.—Title changed to "Structural and ornamental metal work, not made in plants operated in connection with rolling mills."
Wire, drawn from purchased bars or rods.—Title changed to "Wire, drawn from purchased rods."

GROUP 12.—NONFERROUS METALS AND THEIR PRODUCTS

- Clocks, clock movements, time-recording devices, and time stamps.**—Combined with "Watch and clock materials and parts, except watchcases" and "Watches and watch movements", under title "Clocks, watches, time-recording devices, and materials and parts except watchcases."
Copper, tin, and sheet-iron work, including galvanized-iron work, not elsewhere classified.—Title changed to "Sheet-metal work, not specifically classified."
Gas and electric fixtures; lamps, lanterns, and reflectors.—Title changed to "Lighting equipment."
Gold, silver, and platinum, reducing and refining, not from the ore.—Title changed to "Gold, silver, and platinum, refining and alloying."
Jewelers' findings and materials.—New classification; formerly included in "Jewelry."
Jewelry.—Now limited to jewelry only. See "Jewelers' findings and materials," above.
Lighting equipment.—Formerly "Gas and electric fixtures; lamps, lanterns, and reflectors."
Nonferrous-metal alloys and products, not including aluminum products.—Title changed to "Nonferrous-metal alloys; nonferrous-metal products, except aluminum, not elsewhere classified."
Plated ware.—Combined with "Silversmithing and silverware" under new title "Silverware and plated ware."
Sheet-metal work, not specifically classified.—Formerly "Copper, tin, and sheet-iron work, including galvanized-iron work, not elsewhere classified."
Silversmithing and silverware.—See "Plated ware," above.
Silverware and plated ware.—See "Plated ware," above.
Smelting and refining, metals other than gold, silver, or platinum, not from the ore.—Title changed to "Smelting and refining, nonferrous metals other than gold, silver, or platinum, not from the ore."
Watch and clock materials and parts, except watchcases.—See "Clocks, clock movements," etc., above.
Watches and watch movements.—See "Clocks, clock movements," etc., above.

GROUP 13.—MACHINERY, NOT INCLUDING TRANSPORTATION EQUIPMENT

- Electrical machinery, apparatus, and supplies.**—Formerly included manufacture of radio apparatus and tubes, now classified under "Radio apparatus and phonographs." See below.
Engines, turbines, tractors, and water wheels.—Now includes manufacture of windmills and windmill towers, formerly classified separately; title changed to "Engines, turbines, tractors, water wheels, and windmills."
Gas machines, gas meters, and water and other liquid meters.—Title changed to "Meters (gas, water, etc.) and gas generators."
Machine-tool accessories and small metal-working tools, not elsewhere classified.—Title changed to "Machine-tool accessories and machinists' precision tools and instruments."

Radio apparatus and phonographs.—New classification combining manufacture of radio apparatus and tubes, formerly included in "Electrical machinery, apparatus, and supplies," and manufacture of phonographs, formerly a separate industry in Group 16.

Windmills and windmill towers.—Combined with "Engines, turbines, tractors, and water wheels." See above.

GROUP 14.—TRANSPORTATION EQUIPMENT, AIR, LAND, AND WATER

Carriage, wagon, sleigh, and sled materials, made for sale as such.—Abandoned as a separate classification. Turned wood products, such as hubs, felloes, and spokes, are now assigned to "Wood turned and shaped and other wooden goods, not elsewhere classified" (Group 3); and other materials and parts (except springs, which are now and have heretofore been separately classified) are now treated as products of the "Carriages, wagons, sleighs, and sleds" industry.

Locomotives, not made in railroad repair shops.—Title changed to "Locomotives (other than electric), not made in railroad repair shops."

GROUP 15.—RAILROAD REPAIR SHOPS

Car and general construction and repairs, electric railroad shops.—Title changed to "Railroad repair shops, electric."

Car and general construction and repairs, steam railroad shops.—Title changed to "Railroad repair shops, steam."

GROUP 16.—MISCELLANEOUS INDUSTRIES

Dairymen's supplies; creamery, cheese-factory, and butter-factory equipment; and poultrymen's and apiarists' supplies.—Abandoned as a separate classification. Establishments engaged in these lines of manufacture are now classified, according to the character of their principal products, in the following industries: "Flavoring extracts and flavoring sirups" (Group 1); "Planing-mill products (including general millwork), not made in planing mills connected with sawmills" (Group 3); "Sheet-metal work, not specifically classified" (Group 12); "Tin cans and other tinware, not elsewhere classified" (Group 11); "Wood turned and shaped and other wooden goods, not elsewhere classified" (Group 3).

Dental goods and equipment.—Title changed to "Dentists' supplies and equipment, except instruments."

Fancy and miscellaneous articles not elsewhere classified.—Expanded to include "Ivory, shell, and bone work, not including buttons, combs, or hairpins," formerly a separate classification; title changed to "Miscellaneous articles not elsewhere classified."

Instruments, professional and scientific.—Title changed to "Instruments, professional and scientific, and gauges, except machinists' gauges."

Ivory, shell, and bone work, not including buttons, combs, or hairpins.—Combined with "Fancy and miscellaneous articles not elsewhere classified." See above.

Motion pictures.—A report for this industry was published at the census for 1931, but the industry has been removed from the manufactures-census classification and is now in the same category with "Power laundries" and "Dry-cleaning and dyeing establishments."

Paving materials: Asphalt, tar, crushed slag, and mixtures.—Title changed to "Paving materials: Blocks (except brick and stone) and mixtures." The production of crushed slag, formerly classified in this industry, is no longer included. (The crushing of slag and stone are not now treated as manufacturing activities.) Blocks and mixtures for floors, formerly covered by this classification, are now assigned to "Wall plaster, wall board, insulating board, and floor composition." (Group 10).

Photographic apparatus and materials.—Name changed to "Photographic apparatus and materials and projection apparatus."

Phonographs.—Abandoned as a separate classification. See "Radio apparatus and phonographs" (Group 13), above.

Sandpaper, emery paper, and other abrasive paper and cloth.—Abandoned as a separate classification. Now included in "Abrasive wheels, stone, paper, and cloth, and related products" (Group 10). See above.

Soda-water apparatus.—Title changed to "Soda fountains and accessories."

Surgical and orthopedic appliances, including artificial limbs.—Title changed to "Surgical and orthopedic appliances and related products."

Whips.—Abandoned as a separate classification. Now included in "Saddlery and harness" (Group 9). See p. 14.

25. Industrial areas.—Because of the fact that the area of which an important city is the business and industrial center usually extends some distance beyond the municipal boundaries, manufactures statistics for the city alone do not present a true picture of its industrial importance. For this reason 33 "industrial areas" have been established for census purposes. Each of these includes an important manufacturing city, or two or more such cities, and comprises the entire county or counties in which the city or cities are located, together with any adjoining county or counties in which there is great concentration of manufacturing industry. Under normal conditions the factories in each of these industrial areas employ at least 40,000 wage earners, and those in the 33 areas together employ more than half of all the wage earners in manufacturing industries in the United States.

Statistics by industries have been published in the form of mimeographed reports, one for each of 31 of the industrial areas, but none have been issued for the remaining two—Albany-Schenectady-Troy and Dayton—because in each case it is impossible to publish figures either for the most important industry or for industries which in the aggregate contributed at least 50 percent of the total number of wage earners in the area, without disclosing, exactly or approximately, data relating to individual establishments. Because of the necessity for economy, these industrial-area statistics by industries have not been printed and consequently do not appear in this volume; but a summary table giving combined statistics for all industries for each industrial area is included in Chapter II.

The industrial area must not be confused with the "metropolitan district," as established for population-census purposes, which includes, together with the central city or cities, all the adjacent civil divisions having at least 150 inhabitants per square mile. Each industrial area comprises one or more entire counties, whereas all metropolitan districts include parts of counties.

26. Other industrial census statistics.—In addition to the census of manufactures, the Bureau makes special inquiries in regard to production, sales, shipments, stocks, consumption, new orders, etc., of a large number of commodities or classes of commodities.

The reports on these inquiries are issued at intervals ranging from a month to a year, each presenting statistics on some one class or commodities or on some specific industrial trend, service, or condition. These reports cover such subjects as production of boots and shoes, leather and knit wool gloves, men's and boys' clothing, work clothing, and wheat flour; orders for electrical goods; volume of automobile financing and public-merchandise warehousing; manufacturers' sales of automobiles and of paint, varnish, and lacquer products; wool consumption, stocks of wool on hand, and activity of wool machinery; production and shipments of boxboard, hosiery, underwear, malleable castings, etc. These reports are intended to be of current rather than of historical value and are issued within a very short time after the collection of the data.